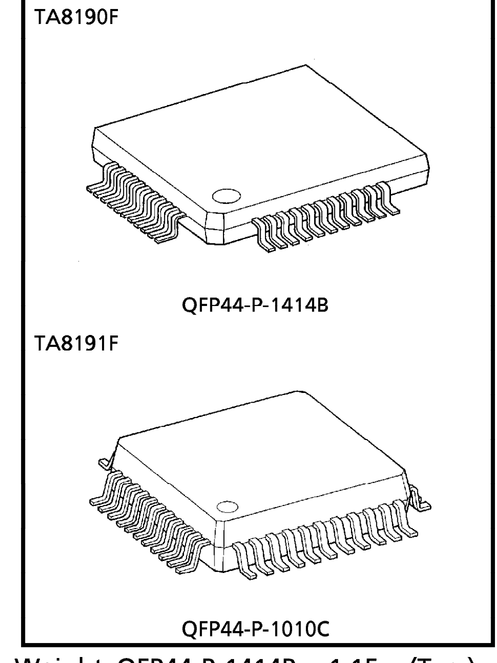
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT

TA8190F, TA8191F

SILICON MONOLITHIC

CD FOCUS TRACKING SERVO LSI

The TA8190F, TA8191F is a 3-beam type PUH compatible focus tracking servo LSIs to be used in the CD player system.
In combination with a CMOS single chip processor TC9236AF, a CD player system can be composed very simply.



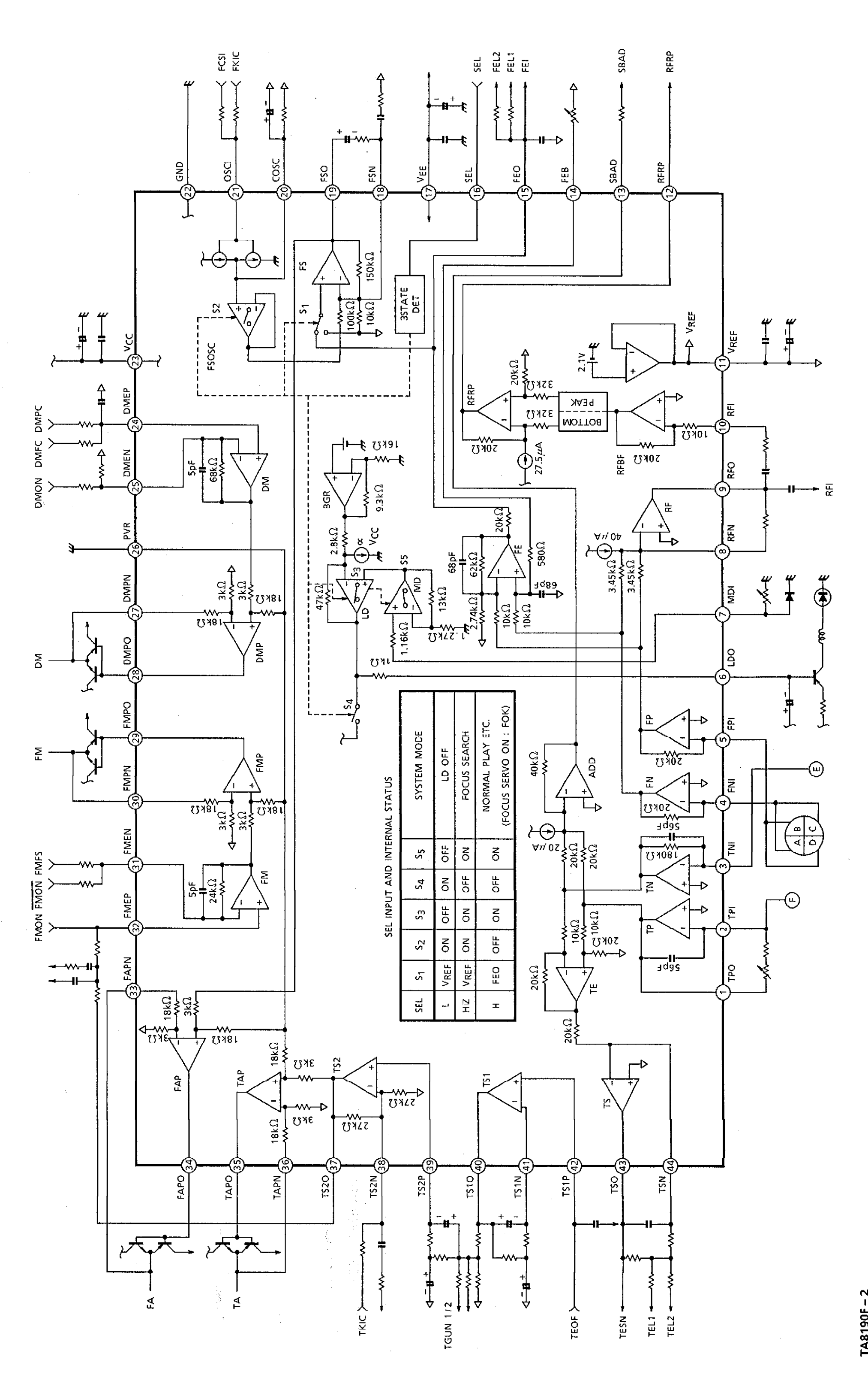
Weight QFP44-P-1414B : 1.15g (Typ.)
QFP44-P-1010C : 0.5g (Typ.)

FEATURES

- Built-in RF amp, focus error amp, and tracking error amp.
- Built-in focus tracking servo amp.
- Built-in phase compensation amp and LPF amp. (Regarding these amp, the pin connection differs between the TA8190F and the TA8191F.)
- Built-in ALPC amp.
- Connections between PUH and power driver IC for motor driver allow simplified structuring of CD player system.
  TA8190F : Directly connectable to a transistor push-pull or power driver (TA8212F).
  TA8191F : Directly connectable to BTL amp (TA8192F) or PWM driver (TA8460F).
- Differences between TA8190F and TA8191F are as follows :

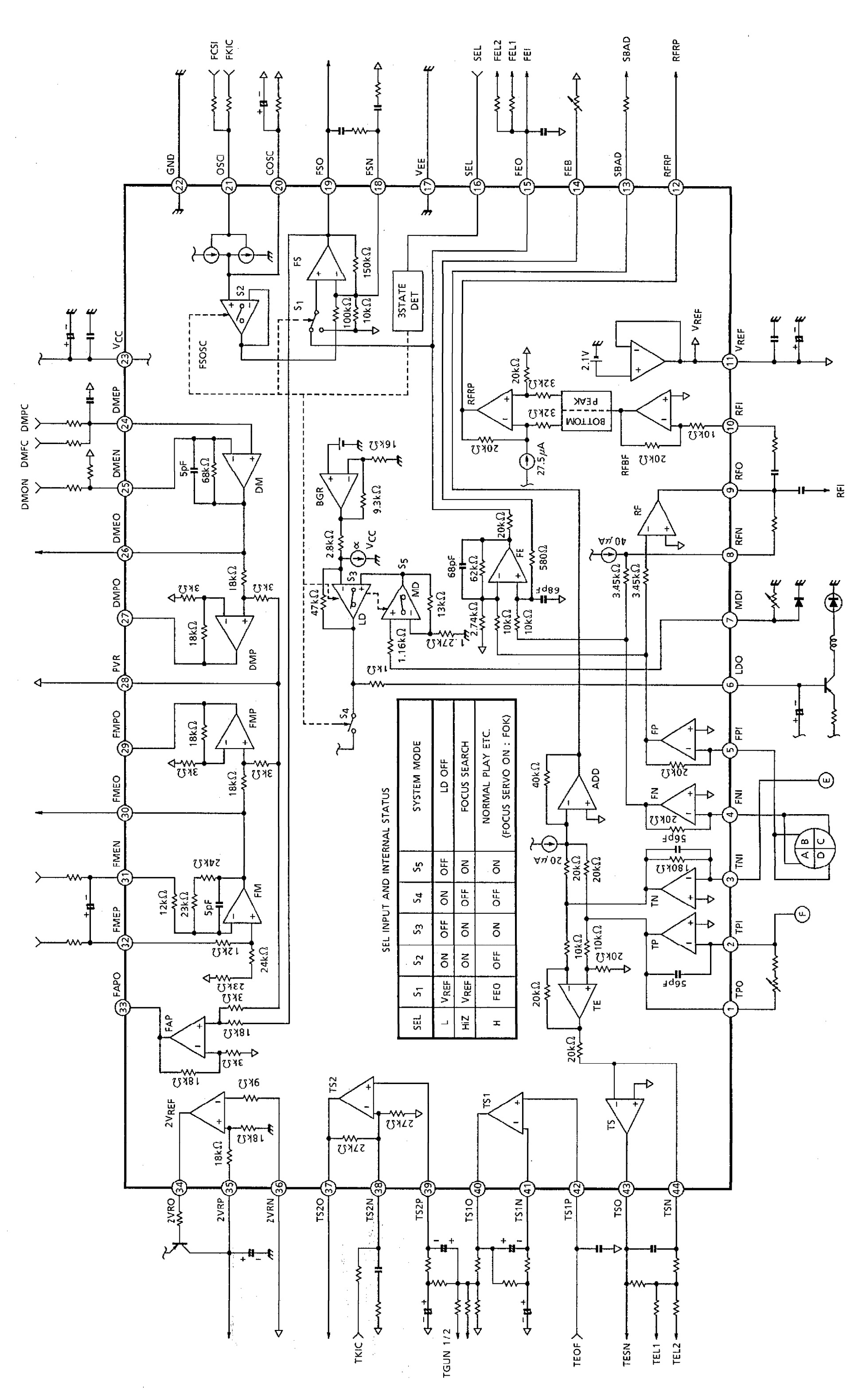
MODEL	REFERENCE VOLTAGE TERMINAL		PACKAGE (FLAT PACKAGE 44 PIN)	POWER SUPPLY	APPLICATION
	V_{REF}	$2V_{REF}$			
TA8190F	Yes	No	QFP44-P-1414B	±5V double power supply	CD player
TA8191F	Yes	Yes	QFP44-P-1010C	+5V single power supply	Portable CD player Radio-cassette CD player

(V_{REF} = 2.1V, $2V_{REF}$ = 4.2V)



SEL INPUT AND INTERNAL STATUS

SEL	S_1	S_2	S_3	S_4	S_5	SYSTEM MODE
L	V_{REF}	ON	OFF	ON	OFF	LD OFF
HiZ	V_{REF}	ON	ON	OFF	ON	FOCUS SEARCH
H	FEO	OFF	ON	OFF	ON	NORMAL PLAY ETC. (FOCUS SERVO ON : FOK)



SEL INPUT AND INTERNAL STATUS

SEL	S_1	S_2	S_3	S_4	S_5	SYSTEM MODE
L	V_{REF}	ON	OFF	ON	OFF	LD OFF
HiZ	V_{REF}	ON	ON	OFF	ON	FOCUS SEARCH
H	FEO	OFF	ON	OFF	ON	NORMAL PLAY ETC. (FOCUS SERVO ON : FOK)

BLOCK DIAGRAM
TA8191F

TA8190F – 3

PIN FUNCTION
(Common)

PIN No.	SYMBOL	I / O	FUNCTIONAL DESCRIPTION	REMARKS
1	TPO	O	Sub-beam I-V amp (TP AMP) output terminal.	Connected to TPI through adjusting feedback resistor.
2	TPI	I	Sub-beam I-V amp (TP AMP) input terminal.	Connected to PIN diode F.
3	TNI	I	Sub-beam I-V amp (TN AMP) input terminal.	Connected to PIN diode E.
4	FNI	I	Main-beam I-V amp (FN AMP) input terminal.	Connected to PIN diode A + C.
5	FPI	I	Main-beam I-V amp (FP AMP) input terminal.	Connected to PIN diode B + D.
6	LDO	O	Laser diode amp (LD AMP) input terminal.	Connected to laser diode circuit.
7	MDI	I	Monitor photo diode amp (MD AMP) input terminal.	Connected to monitor photo diode.
8	RFN	I	RF amp (RF AMP) negative phase input terminal.	Connected to RFO through feedback resistor.
9	RFO	O	RF amp (RF AMP) output terminal.	—
10	RFI	I	RF ripple signal generating circuit input terminal.	Connected to RFO through CR.
11	V_{REF}	O	Reference voltage supply output terminal. (+2.1V)	—
12	RFRP	O	RF ripple signal output terminal.	—
13	SBAD	O	Defects detection signal output terminal.	—
14	FEB	I	Focus error balance adjusting input terminal.	Adjusting semi-fixed resistor connected.
15	FEO	O	Focus error amp (FE AMP) output terminal.	Gain adjusting resistor is connected.
16	SEL	I	Analog switch control signal input terminal.	—
17	V_{EE}	—	Power source terminal. (TA8190F : −5V, TA8191F : GND)	—
18	FSN	I	Focus output amp (FS AMP) negative phase input terminal.	Connected to FSO through feedback CR.
19	FSO	O	Focus output amp (FS AMP) output terminal.	—
20	COSC	O	Focus search signal generating capacitor connecting terminal.	CR is connected.
21	OSCI	I	Focus search signal generating built-in current source control input terminal.	—
22	GND	—	Ground terminal.	—

(Common)

PIN No.	SYMBOL	I / O	FUNCTIONAL DESCRIPTION	REMARKS
23	V_{CC}	—	Power source terminal. (+5V)	—
24	DMEP	I	Disc motor amp (DM AMP) positive phase input terminal.	—
25	DMEN	I	Disc motor amp (DM AMP) negative phase input terminal.	—
31	FMEN	I	Feed motor amp (FM AMP) negative phase input terminal.	—
32	FMEP	I	Feed motor amp (FM AMP) positive phase input terminal.	—
37	TS2O	O	Tracking servo amp 2 (TS2 AMP) output terminal.	—
38	TS2N	I	Tracking servo amp 2 (TS2 AMP) negative phase input terminal.	—
39	TS2P	I	Tracking servo amp 2 (TS2 AMP) positive phase input terminal.	—
40	TS1O	O	Tracking servo amp 1 (TS1 AMP) output terminal.	—
41	TS1N	I	Tracking servo amp 1 (TS1 AMP) negative phase input terminal.	Connected to TS1O through feedback CR.
42	TS1P	I	Tracking servo amp 1 (TS1 AMP) positive phase input terminal.	—
43	TSO	O	Tracking output amp (TS AMP) output terminal.	—
44	TSN	I	Tracking output amp (TS AMP) negative phase input terminal.	Connected to TSO through feedback CR.

(TA8190F)

PIN No.	SYMBOL	I / O	FUNCTIONAL DESCRIPTION	REMARKS
26	PVR	I	Driving amp reference voltage input terminal.	Connect to GND.
27	DMPN	I	Disc motor driving amp (DMP AMP) negative phase input terminal.	—
28	DMPO	O	Disc motor driving amp (DMP AMP) output terminal.	Connected to DMPN through external output Tr.
29	FMPO	O	Feed motor driving amp (FMP AMP) output terminal.	Connected to EMPN through external output Tr.
30	FMPN	I	Feed motor driving amp (FMP AMP) negative phase input terminal.	—
33	FAPN	I	Focus actuator driving amp (FAP AMP) negative phase input terminal.	—
34	FAPO	O	Focus actuator driving amp (FAP AMP) output terminal.	Connected to FAPN through external output Tr.
35	TAPO	O	Tracking actuator driving amp (TAP AMP) output terminal.	Connected to TAPN through external output Tr.
36	TAPN	I	Tracking actuator driving amp (TAP AMP) negative phase input terminal.	—

(TA8191F)

PIN No.	SYMBOL	I / O	FUNCTIONAL DESCRIPTION	REMARKS
26	DMEO	O	Disc motor amp (DM AMP) output terminal.	—
27	DMPO	O	Disc motor driving amp (DM AMP) output terminal.	—
28	PVR	I	Driving amp reference voltage input terminal.	Connected to V_{REF}.
29	FMPO	O	Feed motor driving amp (FMP AMP) output terminal.	—
30	FMEO	O	Feed motor amp (FM AMP) output terminal.	—
33	FAPO	O	Focus actuator driving amp (FAP AMP) output terminal.	—
34	2VRO	O	$2V_{REF}$ amp ($2V_{REF}$ AMP) output terminal.	Connected to 2VRP through external output Tr.
35	2VRP	I	$2V_{REF}$ amp ($2V_{REF}$ AMP) positive phase input terminal.	—
36	2VRN	I	$2V_{REF}$ amp ($2V_{REF}$ AMP) negative phase input terminal.	—

MAXIMUM RATINGS ($Ta = 25°C$)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Power Supply Voltage		V_{CC}-V_{EE}	0.3~12.0	V
Power Dissipation	TA8190F	P_D	960 (*1)	mW
	TA8191F		780 (*2)	
Operating Temperature		T_{opr}	−25~75	°C
Storage Temperature		T_{stg}	−55~150	°C

(*1) Derated above 25°C in the proportion of 7.7mW / °C.
(*2) Derated above 25°C in the proportion of 6.2mW / °C.

ELECTRICAL CHARACTERISTICS
(Unless otherwise specified, TA8190F : $V_{CC} = 5V$, $V_{EE} = -5V$, $Ta = 25°C$
TA8191F : $V_{CC} = 5V$, $V_{EE} = GND$, $Ta = 25°C$)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Power Source (TA8190F)	Power Supply Voltage	V_{CC}	—	Ta = −25~75°C	4.5	5.0	5.5	V
		V_{EE}	—		−5.5	−5.0	−4.5	
	Power Supply Current	I_{CC}	1	SEL = HiZ	14.0	24.0	32.0	mA
		I_{EE}	1	—	3.0	5.0	7.0	
Power Source (TA8191F)	Power Supply Voltage	V_{CC}	—	Ta = −25~75°C	4.5	5.0	5.5	V
	Power Supply Current	ICC	3	—	14.0	24.0	32.0	mA
Reference Power Supply V_{REF} (Common)	Reference Voltage	V_{REF}	1, 3	—	1.95	2.10	2.25	V
	Reference Voltage Temperature Characteristic	$\Delta V / \Delta T$	1, 3	—	−3.0	−2.0	−1.0	mV / °C
	Output Current	I_{OH}	1, 3	—	5.0	—	—	mA
	Input Current	I_{OL}	1, 3	—	5.0	—	—	mA
FI ↓ RFO (Common)	Permissive Input Current	I_{IM}	1, 3	per each ch	30	—	—	μA
	Transfer Resistance	R_T	1, 3	f = 100kHz	115	127	140	kΩ
	Frequency Characteristic	f_c	2, 4	−3dB point	3.0	—	—	MHz
	Output Signal Slew Rate	SR	2, 4	$C_{RFO} = 20pF$	10	20	—	V / μs
	Total Harmonic Distortion	THD	1, 3	f = 100kHz $V_{REO} = 1.27V_{p-p}$	—	−40	−30	dB

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
FI ↓ RFO (Common)	Operation Reference Voltage	V_{OPR}	1, 3	V_{REF} reference	−1.13	−0.88	−0.72	V
	Upper Limit Output Voltage	V_{OH}	1, 3	V_{REF} reference	1.4	—	—	V
	Lower Limit Output Voltage	V_{OL}	1, 3	V_{REF} reference	—	—	−1.4	V
	Permissive Load Resistance	R_{LM}	—	—	10	—	—	kΩ
RFI ↓ RFRP (Common)	Input Operating Voltage	V_I	1, 3	—	0.8	—	1.6	$V_{p\text{-}p}$
	Voltage Gain	G_V	1, 3	f = 1kHz	0.55	0.62	0.69	V / V
	Peak Hold Frequency Characteristic	f_{CPD}	1, 3	—	60	120	240	kHz
	Bottom Hold Frequency Characteristics	f_{CBD}	1, 3	—	60	120	240	kHz
	Operation Reference Voltage 1	V_{OPR}	1, 3	V_{REF} reference	−0.61	−0.55	−0.49	V
	Operation Reference Voltage 2	V_{OPR}	1, 3	V_{REF} reference 700kHz, 1$V_{p\text{-}p}$ input	−120	0	120	mV
	Permissive Load Resistance	R_{LM}	—	—	10	—	—	kΩ
FI ↓ FEO (Common)	Transfer Resistance	R_T	1, 3	f = 1kHz	97	124	151	kΩ
	Gain Balance	GB	1, 3	f = 1kHz	−1.5	—	1.5	dB
	Frequency Characteristic	f_c	1, 3	−3dB point	20	30	60	kHz
	Total Harmonic Distortion	THD	1, 3	f = 1kHz V_{FEO} = 1.7$V_{p\text{-}p}$	—	—	−40	dB
	Output Offset Voltage	V_{OS}	1, 3	V_{REF} reference	−100	—	100	mV
	Offset Voltage Drift	$\Delta V / \Delta T$	1, 3	—	−400	—	400	μV / °C
	Upper Limit Output Voltage	V_{OH}	1, 3	V_{REF} reference	1.5	—	—	V
	Lower Limit Output Voltage	V_{OL}	1, 3	V_{REF} reference	—	—	−1.5	V

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
TI ↓ TSO (Common)	Permissive Input Current	I_{IM}	1, 3	Per each ch	5.0	—	—	μA
	Transfer Resistance	R_T	1, 3	f = 1kHz	354	432	554	kΩ
	Gain Balance	GB	1, 3	f = 1kHz	− 2.0	—	2.0	dB
	Frequency Characteristic	f_c	1, 3	− 3dB point	10	16	30	kHz
	Total Harmonic Distortion	THD	1, 3	f = 1kHz V_{TSO} = 0.8V_{p-p}	—	—	− 40	dB
	Output Offset Voltage	V_{OS}	1, 3	V_{REF} reference	− 50	—	50	mV
	Offset Voltage Drift	$\Delta V / \Delta T$	1, 3	—	− 200	—	200	μV / °C
	Upper Limit Output Voltage	V_{OH}	1, 3	V_{REF} reference	1.5	—	—	V
	Lower Limit Output Voltage	V_{OL}	1, 3	V_{REF} reference	—	—	− 1.5	V
	Permissive Load Resistance	R_{LM}	—	—	10	—	—	kΩ
TI ↓ SBAD (Common)	Permissive Input Current	I_{IM}	1, 3	Total in both ch	7.0	—	—	μA
	Transfer Resistance	R_T	1, 3	f = 1kHz	280	360	440	kΩ
	Frequency Characteristic	f_c	1, 3	− 3dB point	10	16	30	kHz
	Total Harmonic Distortion	THD	1, 3	f = 1kHz V_{SBAD} = 1.6V_{p-p}	—	—	− 40	dB
	Operation Reference Voltage	V_{OPR}	1, 3	V_{REF} reference	− 0.88	− 0.80	− 0.72	V
	Upper Limit Output Voltage	V_{OH}	1, 3	V_{REF} reference	1.5	—	—	V
	Lower Limit Output Voltage	V_{OL}	1, 3	V_{REF} reference	—	—	− 1.5	V
	Permissive Load Resistance	R_{LM}	—	—	10	—	—	kΩ
OSCI ↓ FSO (Common)	Output Amplitude	V_O	—	f_{OSCI} = 0.5Hz (CMOS level)	610	700	780	mV_{p-p}
	Output Offset Voltage	V_{OS}	—	OSCI : HiZ	− 35	—	35	mV
	Output Switch Isolation	V_{ISO}	—	f_{OSCI} = 0.5Hz SEL : "H" level	—	—	25	mV_{p-p}

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
FEO ↓ FSO (TA8190F)	Voltage Gain 1	G_{V1}	—	f = 10kHz V_{FSO} = 1V_{p-p}	14.5	16.0	17.5	V / V
	Voltage Gain 2	G_{V2}	—	R_{NF} (FSO-FSN) : 12kΩ	1.79	2.11	2.43	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	0.5	V
	Output Offset Voltage	V_{OS}	—	—	−32	—	32	mV
	Total Harmonic Distortion	THD	—	f = 10kHz V_{FSO} = 1V_{p-p}	—	—	−40	dB
FEO ↓ FSO (TA8191F)	Voltage Gain 1	G_{V1}	—	f = 10kHz V_{FSO} = 1V_{p-p}	14.5	16.0	17.5	V / V
	Voltage Gain 2	G_{V2}	—	R_{NF} (FSO-FSN) : 12kΩ	1.79	2.11	2.43	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	0.5	V
	Output Offset Voltage	V_{OS}	—	—	−32	—	32	mV
	Total Harmonic Distortion	THD	—	f = 10kHz V_{FSO} = 1V_{p-p}	—	—	−40	dB
FEO ↓ FAPO (TA8190F)	Voltage Gain	G_V	—	f = 10kHz V_{FAPO} = 1V_{p-p}	80	96	114	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	2.8	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	−2.8	V
	Output Offset Voltage	V_{OS}	—	—	−200	—	200	mV
	Total Harmonic Distortion	THD	—	f = 10kHz V_{FAPO} = 1V_{p-p} R_L = 8Ω	—	—	−40	dB

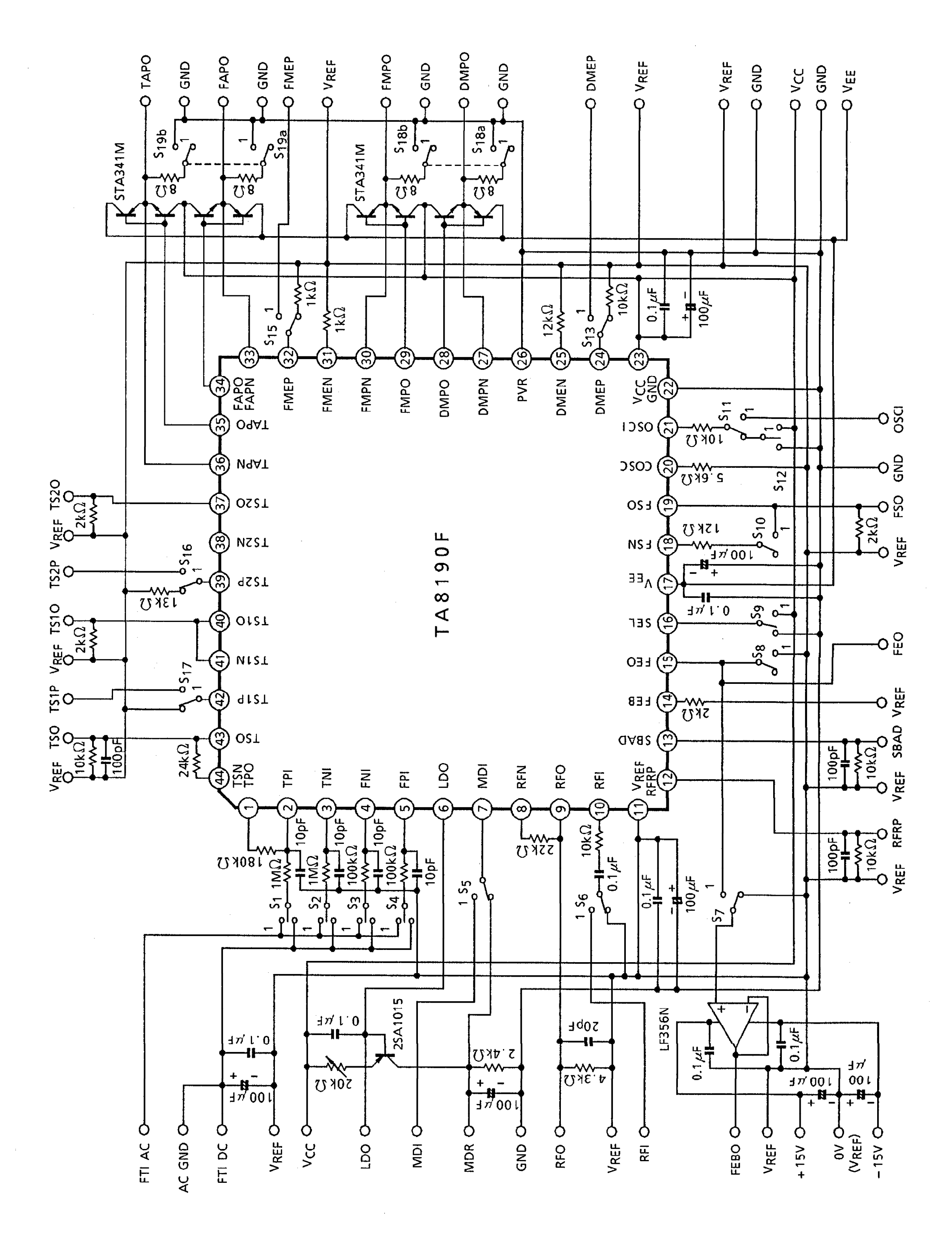
CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
FEO ↓ FAPO (TA8191F)	Voltage Gain	G_V	—	f = 10kHz $V_{FAPO} = 1V_{p-p}$	14.0	16.0	18.0	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	1.0	V
	Output Offset Voltage	V_{OS}	—	—	− 40	—	40	mV
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{FAPO} = 1V_{p-p}$	—	—	− 40	dB
TS1P ↓ TS1O (Common)	Voltage Gain	G_V	—	f = 10kHz $V_{TS1O} = 1V_{p-p}$	0.95	1.00	1.05	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	1.0	V
	Output Offset Voltage	V_{OS}	—	—	− 5.0	—	5.0	mV
	Input Bias Current	I_I	—	—	− 100	—	100	nA
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{TS1O} = 1V_{p-p}$	—	—	− 40	dB
TS2P ↓ TS2O (Common)	Voltage Gain	G_V	—	f = 10kHz $V_{TS2O} = 1V_{p-p}$	1.9	2.0	2.1	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	0.5	V
	Output Offset Voltage	V_{OS}	—	—	− 10	—	10	mV
	Input Bias Current	I_I	—	—	− 100	—	100	nA
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{TS2O} = 1V_{p-p}$	—	—	− 40	dB

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
TS2P ↓ TAPO (TA8190F)	Voltage Gain	G_V	—	f = 10kHz $V_{TAPO} = 1V_{p\text{-}p}$	10.5	12.0	13.5	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	2.8	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	– 2.8	V
	Output Offset Voltage	V_{OS}	—	—	– 80	—	80	mV
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{TAPO} = 1V_{p\text{-}p}$ $R_L = 8\Omega$	—	—	– 40	dB
DMEP ↓ DMEO (TA8191F)	Voltage Gain	G_V	—	f = 10kHz $V_{DMEO} = 1V_{p\text{-}p}$	5.7	6.7	7.7	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	0.5	V
	Output Offset Voltage	V_{OS}	—	—	– 15	—	15	mV
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{DMEO} = 1V_{p\text{-}p}$	—	—	– 40	dB
DMEP ↓ DMPO (TA8190F)	Voltage Gain	G_V	—	f = 10kHz $V_{DMPO} = 1V_{p\text{-}p}$	32	40	50	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	2.8	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	– 2.8	V
	Output Offset Voltage	V_{OS}	—	—	– 100	—	100	mV
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{DMPO} = 1V_{p\text{-}p}$ $R_L = 8\Omega$	—	—	– 35	dB

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
DMEP ↓ DMPO (TA8191F)	Voltage Gain	G_V	—	f = 10kHz, V_{DMPO} = 1V_{p-p}	5.4	6.7	8.0	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	1.2	V
	Output Offset Voltage	V_{OS}	—	—	−30	—	30	mV
	Total Harmonic Distortion	THD	—	f = 10kHz, V_{DMPO} = 1V_{p-p}	—	—	−40	dB
FMEP ↓ FMEO (TA8191F)	Voltage Gain	G_V	—	f = 10kHz, V_{FMEO} = 1V_{p-p}, V_{FMEN} = V_{REF}	3.6	3.9	4.3	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	0.5	V
	Output Offset Voltage	V_{OS}	—	—	−15	—	15	mV
	Total Harmonic Distortion	THD	—	f = 10kHz, V_{FMEO} = 1V_{p-p}	—	—	−40	dB
FMEP ↓ FMPO (TA8190F)	Voltage Gain	G_V	—	f = 10kHz, V_{FMPO} = 1V_{p-p}	124	150	177	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	2.8	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	−2.8	V
	Output Offset Voltage	V_{OS}	—	—	−500	—	500	mV
	Total Harmonic Distortion	THD	—	f = 10kHz, V_{FMPO} = 1V_{p-p}, R_L = 8Ω	—	—	−30	dB

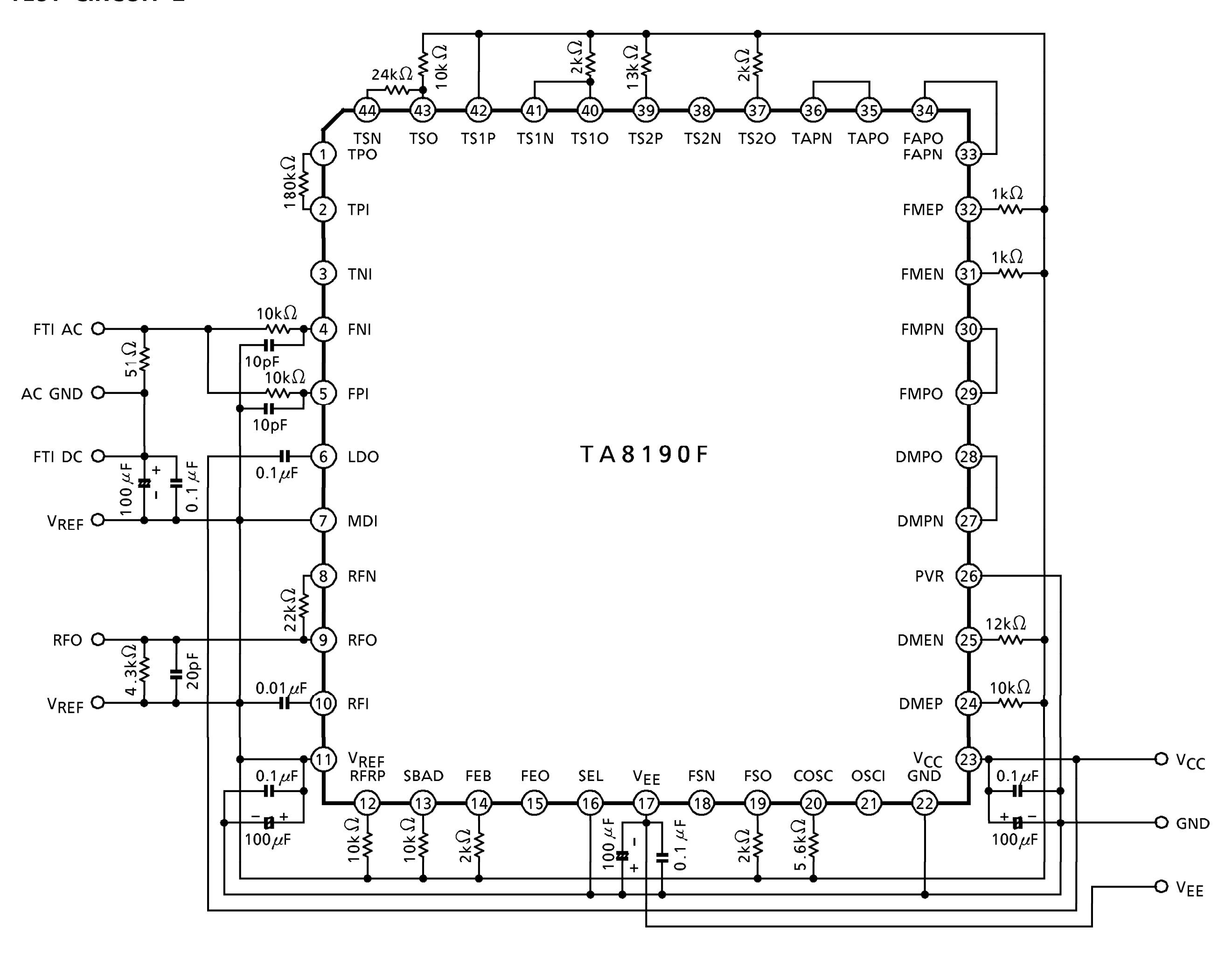
CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
FMEP ↓ FMPO (TA8191F)	Voltage Gain	G_V	—	f = 10kHz $V_{FMPO} = 1V_{p-p}$ $V_{FMEN} = V_{REF}$	3.4	3.9	4.6	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	1.0	V
	Output Offset Voltage	V_{OS}	—	—	−20	—	20	mV
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{FMPO} = 1V_{p-p}$	—	—	−40	dB
2VRN ↓ 2VR (TA8191F)	DC Voltage Gain	G_{VDC}	—	$V_{2VR} = V_{REF}$	1.90	2.00	2.10	V / V
MDI ↓ LDO (Common)	Reference Operating Voltage	V_{MDI}	—	V_{MDI} at which V_{LDO} becomes 3.5V.	170	178	192	mV
	Voltage Gain	G_V	—	f = 10kHz $V_{LDO} = 0.5V_{p-p}$	170	200	230	mV
	Input Bias Current	I_I	—	—	−200	—	200	nA
	Ripple Removing Ratio (With V_{CC})	RR	—	Input converted value	—	—	−56	dB
	Frequency Characteristic	f_c	—	−3dB point	20	—	—	kHz
	LD Off Voltage (With V_{CC})	$V_{LD\ OFF}$	—	SEL = L	−0.7	—	—	V

TEST CIRCUIT 1

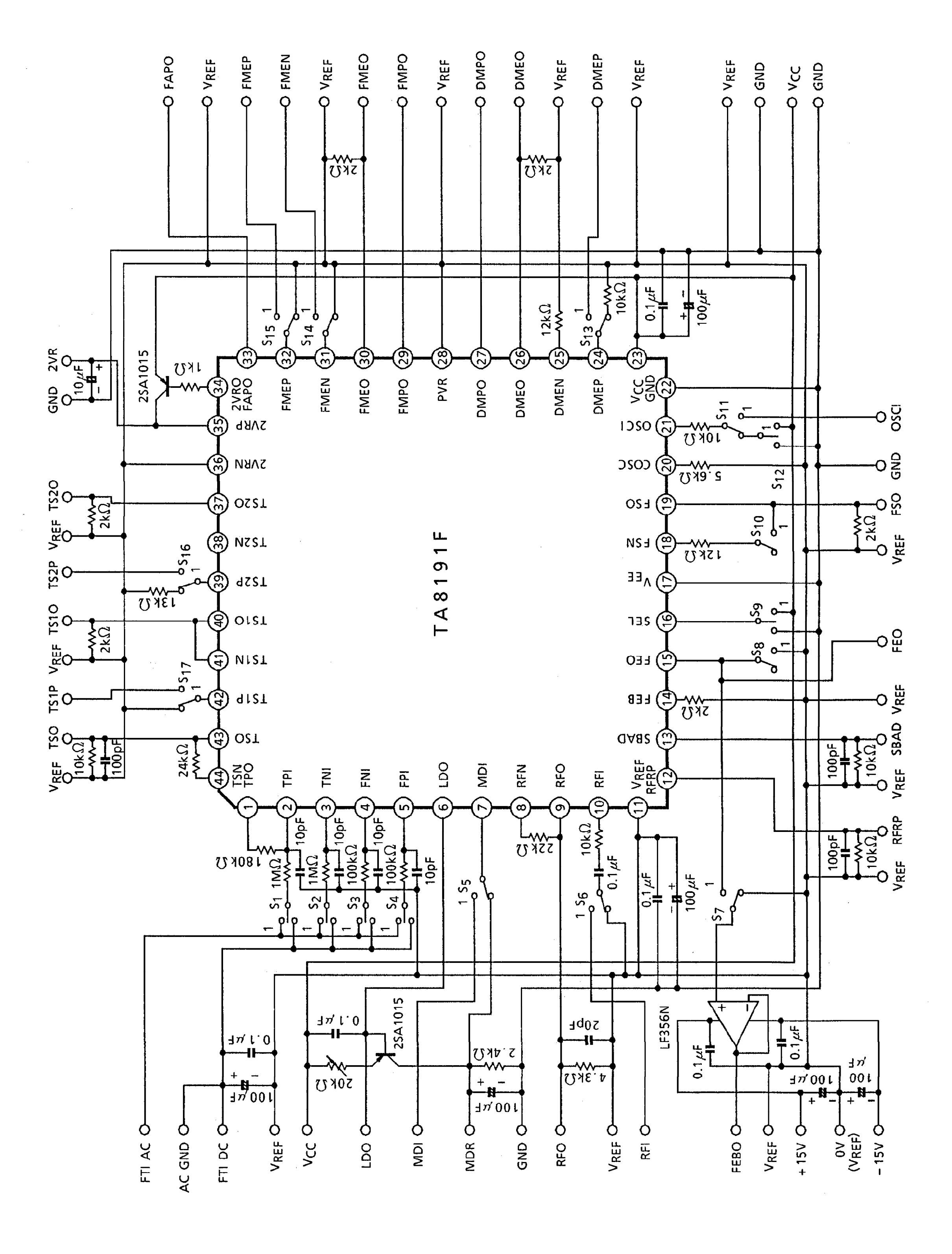


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TEST CIRCUIT 2

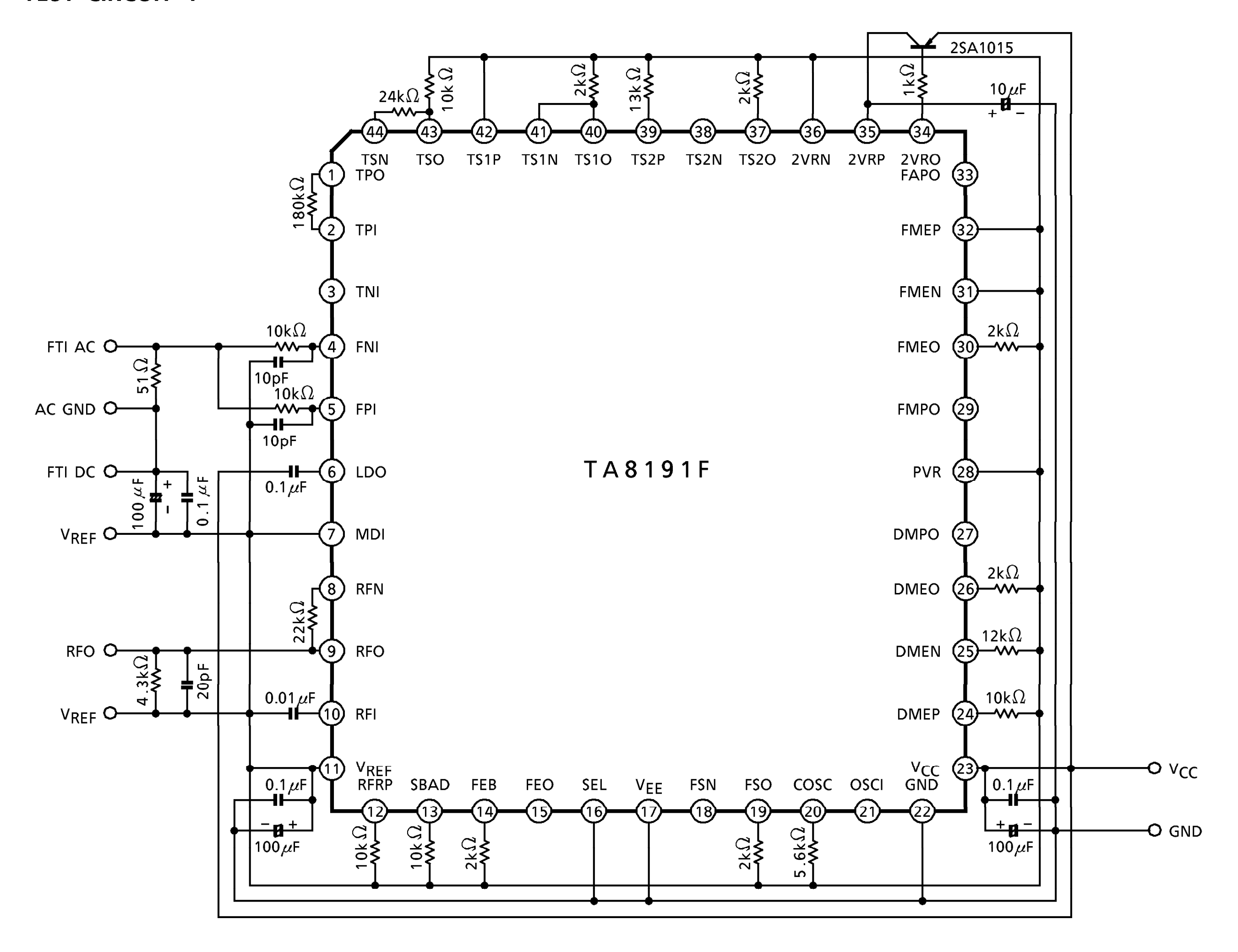


TEST CIRCUIT 3



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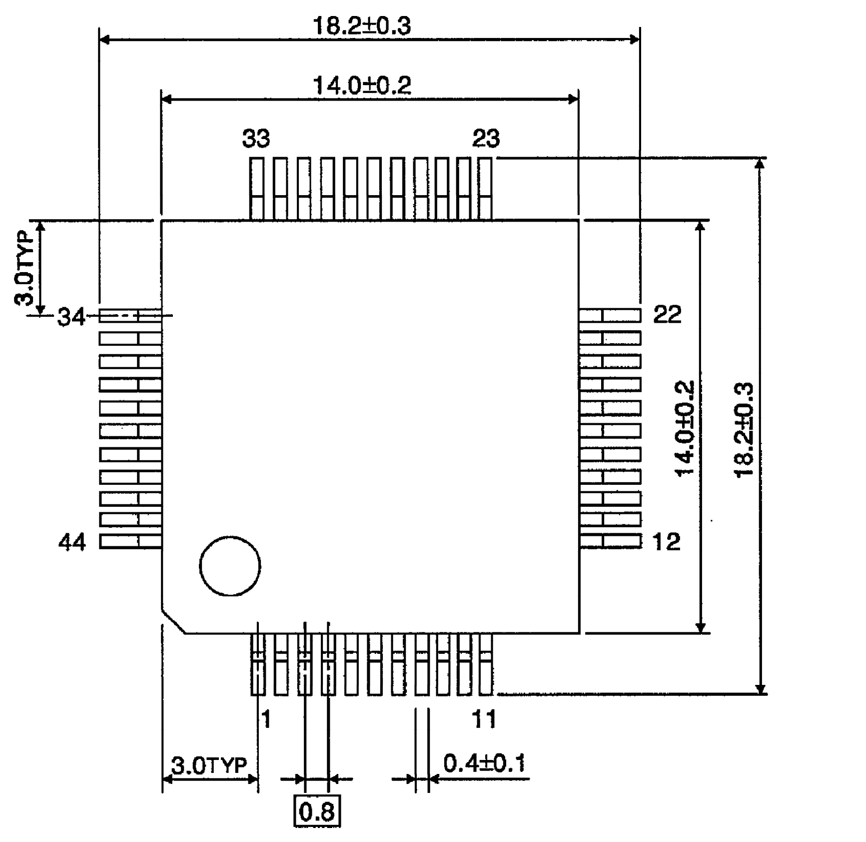
TEST CIRCUIT 4

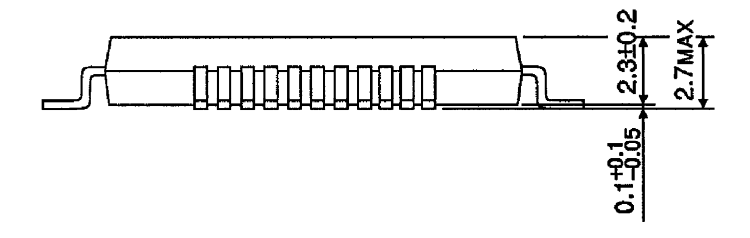


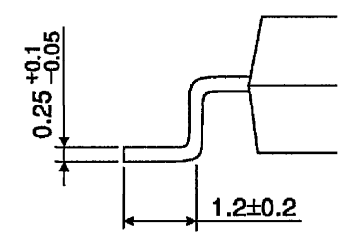


OUTLINE DRAWING
QFP44-P-1414B

Unit : mm



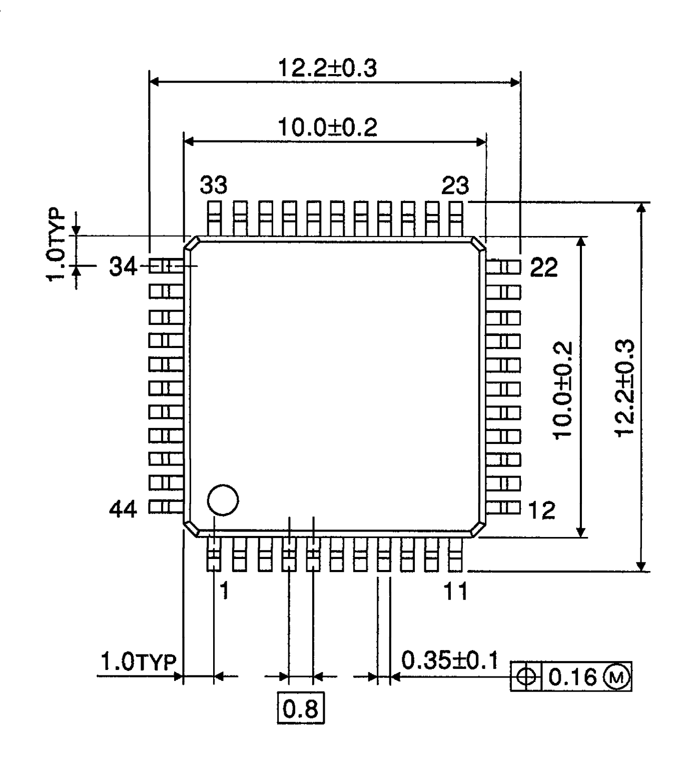


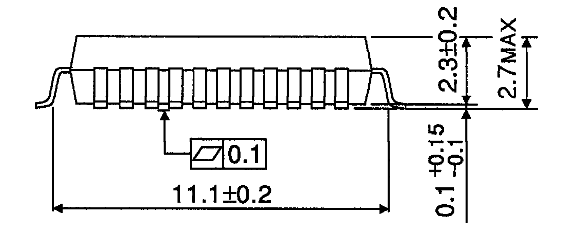


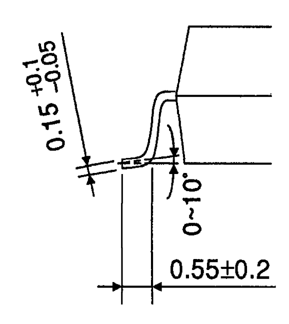
Weight : 1.15g (Typ.)

OUTLINE DRAWING
QFP44-P-1010C

Unit : mm







Weight : 0.5g (Typ.)